Magnetic soft X-ray microscopy at XM-1

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The challenge to modern magnetic microscopies is to provide both spatial resolution in the nanometer regime, a time resolution on a ps to fs scale and elemental specificity so as to address novel multicomponent and multifunctional magnetic nanostructures and their ultrafast spin dynamics which are of both fundamental and technological interest.

Magnetic soft X-ray microscopy combines X-ray magnetic circular dichroism (X-MCD) as element specific magnetic contrast mechanism with high spatial and temporal resolution. Fresnel zone plates used as X-ray optical elements provide a spatial resolution down to currently <15nm [1] approaching fundamental magnetic length scales such as the grain size [2] and magnetic exchange lengths. Images can be recorded in external magnetic fields giving access to study magnetization reversal phenomena on the nanoscale. Utilizing the inherent time structure of current synchrotron sources fast magnetization dynamics with 70ps time resolution, limited by the lengths of the electron bunches, can be performed with a stroboscopic pump-probe scheme [3]. I will present recent achievements of magnetic soft X-ray microscopy at BL 6.1.2 by selected examples on magnetic multilayers and nanostructured systems where both classical Oersted fields as well as spin torque phenomena are used to manipulate the magnetisation [4]. Future perspectives of magnetic soft X-ray microscopy aim for <10nm spatial and fs time resolution.

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